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Statistical Analysis of Abandoned Mine Drainage in the Assessment of Pollution Load ("The Griffiths Report")

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("The Griffiths Report")

Prepared for:

U.S. Environmental Protection Agency
Office of Water
Office of Science and Technology
Engineering and Analysis Division

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DEDICATION

John C. Griffiths was one of the early leaders in the use of statistics in the geological sciences. As an attest to his world class stature, he was the first recipient of the William C. Krumbein Award by the International Association of Mathematical Geology in 1977, named after one of his contemporaries. Griffiths, Krumbein, Felix Chayes and a few others introduced geologists and geological students to statistical methods in sampling, experimental design, petrology, mineralogy, sedimentology, stratigraphy and other aspects of the geosciences throughout the 1950's, 1960's and 1970's as documented in approximately 100 scientific papers and several text books.

John Griffiths was born on February 29, 1912 in Wales. He earned 3 degrees from the University of Wales including a PhD in 1937 in glacial geology and petrography, a Diploma of Imperial College at the Royal College of Science in London, and a second PhD from the University of London in 1940. He was employed as a research petrographer on oil well drilling projects from 1940 to 1947 in Trinidad, where he was married on July 26, 1941. He was a professor in geosciences at the Pennsylvania State University from 1947 to his retirement in 1977, and thereafter was a Professor Emeritus until his death on June 2, 1992 in State College, PA. The day before his death at age 80, he was conducting research in the Earth and Mineral Sciences Library at Penn State. During his many years as a professor, he served as the Head of the Department of Mineralogy (and Geochemistry) from 1955 to 1966, and as the Director of Planning Research for the entire University from 1969 to 1971.

Dr. Griffiths was an excellent teacher who instilled scientific rigor and an appreciation for proper sampling and the use of statistics in the minds of many students. While at Pennsylvania State University, he taught univariate statistics, bivariate statistics, and multivariate statistics; periodically, he also taught a course in time series analysis. New graduate students, relying upon the foundation of their undergraduate studies, would be confronted by this feisty Welshman, armed with more than 20 years of data on a local stratified gravel deposit from previous classes, saying things like "You call yourselves geologists; you can't even tell me how many layers there are in this gravel deposit." Students soon learned that Dr. Griffiths was challenging them to use statistical analysis as a guide to the unknown in a scientific method for solving problems in the geosciences.

J.C. Griffiths approached teaching, research and much of life in general, with a blend of humor, history, and lessons learned from other sciences, observations from current events, and a strong foundation of scientific rigor and ethics. With the advances in computer science in the 1950's and 1960's, Griffiths expanded his areas of interest into related fields of computer modeling, operations research and cybernetics. In the 1960's and 1970's, he proposed drilling the entire United States on a 20-mile grid spacing, wherein approximately 7500 drill holes each 10,000 to 15,000 feet deep would almost certainly result in the discovery of billions of dollars worth of oil, gold, uranium, zinc, copper and other valuable minerals overlooked by conventional "hit-and-miss" type of exploration. In the early days of research on the correlation between cigarette smoking and the incidence of lung cancer, Griffiths was requested to meet with a famous statistical researcher for dinner the evening before his cancer research speech at the University. Griffiths was a smoker at that time, and his recollection of the evening was, "I

took one look at that man's statistics and I knew that I had 2 choices: I either had to give up cigarettes or give up statistics."

Following his retirement from the full time faculty in 1977, J. C. Griffiths worked with the U. S. Geological Survey in Reston VA and continued his research with graduate students on quantifying the geology of the world by country for mineral resource assessment purposes. He served as a consultant to DER (now DEP) and EPA from 1984 to 1988 on a cooperative project to support development of Pennsylvania's Coal Remining regulatory package.

Beyond his many professional accomplishments, John C. Griffiths was a great person. This document was prepared in his honor and with great respect for his accomplishments as a geostatistician, a teacher, and a major contributor to our understanding of sedimentary and geochemical processes.

DISCLAIMER

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